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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 09/470,236
Filing Date: November 15, 1999
Appellant(s): BAILEY ET AL.

Marc S. Hannish
For Appellant

EXAMINER'S ANSWER

Beyer Weaver & Thomas, LLP

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This is in response to the appeal brief filed September 14, 2006 appealing from the Office action mailed March 9, 2006.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

Claims 1-10, 16, 17, 19, 23-25, 28-33, 35, 36, 42-45, 48, 50, 54, and 57-75 are pending in the application. Claims 1-10, 16-17, 19, 23-25, 28-33, 35-36, 42-45, 48, 50, 54, are 57-75 rejected.

(4) Status of Amendments After Final

No amendment after final has been filed.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

The invention pertains to improved techniques for etch processing in a plasma processing system. In accordance with one aspect, the present invention can be utilized to enhance control of the etching process by a plasma processing system that includes a plasma processing chamber. The plasma processing chamber is connected to a gas flow system. The gas flow system can be employed to control the release of gases into the plasma processing chamber to multiple, different locations. Moreover, the gas flow system enables the control over the amount, volume or relative flow of gas released into the plasma processing chamber.

One aspect of the invention includes: a plasma processing chamber used to process a substrate; and a gas flow system coupled to the plasma processing chamber. The gas flow system controls flow of input gas into at least two different regions of the plasma processing chamber. As examples, at least two different regions can be selected from a top region and a peripheral region.

Another aspect of the invention includes: a substantially azimuthally symmetric cylindrical plasma processing chamber within which a plasma is both ignited and sustained for the processing, the plasma processing chamber having no separate plasma generation chamber, the plasma processing chamber having an upper end and a lower end; a coupling window disposed at an upper end of the plasma processing chamber; an RF antenna arrangement disposed above a plane defined by the substrate when the substrate is disposed within the plasma processing chamber for the processing; an electromagnet arrangement disposed above the plane defined by the substrate, the electromagnet arrangement being configured so as to result in a radial variation in the static magnetic field topology within the plasma processing chamber in the region proximate the RF antenna when at least one direct current is supplied to the electromagnet

arrangement, the radial variation being effective to affect processing uniformity across the substrate; a dc power supply coupled to the electromagnet arrangement, the dc power supply having a controller to vary a magnitude of the at least one direct current, thereby changing the radial variation in the magnetic field topology within the plasma processing chamber in the region proximate the antenna to improve the processing uniformity across the substrate; and a gas flow system coupled to the plasma processing chamber, the gas flow system controlling flow if input gas into at least two different regions of the plasma processing chamber.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

The issues are if:

1. Claims 63 and 69 have been rejected less than 35 U.S.C. § 112 as failing to comply with the written description requirement.

2. Claims 1, 3, 7-10, 16-17, 70-71, and 75 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over US Patent No. 6,009,830 issued to Li et al. in view of Fujii et al., US Patent No. 4,980,204 or Fujiyama et al., US Patent No. 4,529,474, or Yamazaki et al., US Patent No. 4,105,810.

3. Claims 1-5, 7-10, 16-17, 50, 57, 59, 62, 67-68, 70-71, and 75 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Li et al., US Patent No. 6,070,551 in view of Fujii et al., US Patent No. 4,980,204, or Fujiyama et al., US Patent No. 4,529,474, or Yamazaki et al., US Patent No. 4,105,810.

4. Claim 6 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Li

et al., US Patent No. 6,070,551 in view of Fujii et al., US Patent No. 4,980,204, or Fujiyama et al., US Patent No. 4,529,474, or Yamazaki et al., US Patent No. 4,105,810, as applied to claims 1-5, 7-10, 16-17, 50, 57, 59, 62, 67-68, 70-71, and 75, and further in view of Wing et al., US Patent No. 6,277,235.

5. Claims 58, 60-61, and 63-65 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Li et al., US Patent No. 6,070,551 in view of Fujii et al., US Patent No. 4,980,204, or Fujiyama et al., US Patent No. 4,529,474, or Yamazaki et al., US Patent No. 4,105,810, as applied to claims 1-5, 7-10, 16-17, 50, 57, 59, 62, 67-68, 70-71, and 75, and further in view of Li et al., US Patent No. 6,009,830.

6. Claims 1-5, 7-9, 16-17, 19, 23-25, 28-33, 35, 42-44, 48, 50, 54, 66-68, 70-73, and 75 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Collins et al., US Patent No. 6,024,826 in view of Fujii et al., US Patent No. 4,980,204, or Fujiyama et al., US Patent No. 4,529,474, or Yamazaki et al., US Patent No. 4,105,8!0.

7. Claims 6 and 36 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Collins et al., US Patent No. 6,024,826 in view of Fujii et al., US Patent No. 4,980,204, or Fujiyama et al., US Patent No. 4,529,474, or Yamazaki et al., US Patent No. 4,105,810, as applied to claims 1-5, 7-9, 16-17, 19, 23-25, 28-33, 35, 42-44, 48, 50, 54, 66-68, 70-73, and 75, and further in view of Wing et al., US Patent No. 6,277,235.

8. Claims 10 and 57-65 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Collins et al., US Patent N Patent No. 4,980,204, or Fujiyama et al., US Patent No. 4,529,474, or Yamazaki et al., US Patent No. 4,105,810, as applied to claims 1-5, 7-9, 16-17,

19, 23-25, 28-33, 35, 42-44, 48, 50, 54, 66-68, 70-73, and 75, and further in view of Li et al., US Patent No. 6,070,551.

9. Claims 45 and 74 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Collins et al., US Patent No. 6,024,826 in view of Fujii et al., US Patent No. 4,980,204, or Fujiyama et al., US Patent No. 4,529,474, or Yamazaki et al., US Patent No. 4,105,810, as applied to claims 1-5, 7-9, 16-17, 19, 23-25, 28-33, 35, 42-44, 48, 50, 54, 66-68, 70-73, and 75, and further in view of Ueda et al., US Patent No. 5,810,932 and Kadomura, US Patent No. 6,096,160.

10. Claims 1-5, 7-10, 16-17, 19, 23-25, 28-33, 35, 42-44, 48, 54, 57, 59, 62, 66, 70-72, and 75 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Murugesh et al., US Patent No. 6,228,781 in view of Fujii et al., US Patent No. 4,980,204, or Fujiyama et al., US Patent No. 4,529,474, or Yamazaki et al., US Patent No. 4,105,810.

11. Claims 6 and 36 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Murugesh et al., US Patent No. 6,228,781 in view of Fujii et al., US Patent No. 4,980,204, or Fujiyama et al., US PatentNo. 4,529,474, or Yamazaki et al., US Patent No. 4,105,810, as applied to claims 1-5, 7-10, 16-17, 19, 23-25, 28-33, 35, 42-44, 48, 54, 57, 59, 62, 66, 70-72, and 75, and further in view of Wing et al., US Patent No. 6,277,235.

12. Claims 45 and 74 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Murugesh et al., US Patent No. 6,228,781 in view of Fujii et al., US Patent No. 4,980,204, or Fujiyama et al., US Patent No. 4,529,474, or Yamazaki et al., US Patent No. 4,105,810, as applied to claims 1-5, 7-10, 16-17, 19, 23-25, 28-33, 35, 42- 44, 48, 54, 57, 59, 62,

66, 70-72, and 75, and further in view of Ueda et al., US PatentNo. 5,810,932 and Kadomura, US Patent No. 6,096,160.

13. Claims 58 and 60-61 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Murugesh et al., US Patent No. 6,228,781 in view of Fujii et al., US Patent No. 4,980,204, or Fujiyama et al., US Patent No. 4,529,474, or Yamazaki et al., US Patent No. 4,105,810, as applied to claims 1-5, 7-10, 16-17, 19, 23-25, 28-33, 35, 42- 44, 48, 54, 57, 59, 62, 66, 70-72, and 75, and further in view of Li et al., US Patent No. 6,009,830.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

6,009,830	Li et al.	01-2000
4,980,204	Fujii et al.	12-1990
4,529474	Fujiyama et al.	07-1985
4,105,810	Yamazaki et al.	08-1978
6,228,781	Murugesh et al.	05-2001
6,277,235	Wing et al.	08-2001
5,810,932	Ueda et al.	09-1998
6,024,826	Collins et al.	02-2000
6,070,551	Li et al.	06-2000
6,096,160	Kadomura	08-2000

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 63 and 69 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

In the specification, as originally filed, there is no support for the limitation "the gas distribution plate and the gas ring cooperating to release the identical input gas in an azimuthally symmetric manner inside the plasma process chamber" as disclosed in claim 63, lines 4-5. There is nothing in the specification to indicate that the gases will have exactly or identical compositions. Furthermore, the specification, as originally filed, fails to find support for the limitation "a single source of input gas" as recited in claim 69-line 8. It appears from fig. 2 that more than one gas source is contemplated.

Claims 1, 3, 7-10, 16-17, 70-71, and 75 are rejected over 35 USC 103(a) as being unpatentable over Li et al., U.S. Patent 6,009,830 in view of Fujii et al., U.S. Patent 4,980,204, or Fujiyama et al., U.S. Patent 4,529,474, or Yamazaki et al., U.S. Patent 4,105,810.

Li et al. shows substantially the invention as claimed including a plasma processing system, said plasma processing system comprising: a substantially cylindrical plasma processing chamber 8 used to process a substrate 10, said substantially cylindrical plasma processing chamber including a top region 38 located on the top surface of said substantially cylindrical

plasma processing chamber, an upper peripheral region (40) located on a surface surrounding the periphery of said substantially cylindrical plasma processing chamber including at least an inner wall; a gas flow system operated by a processor 76 and coupled to said plasma processing chamber, said gas flow system using controllers (e.g. 52, 56, 60, 62) to control the flow of input gas into at least two different regions of said plasma processing chamber and comprising a gas inlet for receiving input gas to be delivered into the plasma processing chamber and at least first and second gas outlets 50, 54; wherein said at least two different regions include a lower peripheral region and a top region of the chamber and the peripheral region is not part of the top region (see Fig. 2 and its description).

Li et al. does not expressly disclose a gas inlet receiving a single input gas comprising a mixture of etching gases and delivering the single input gas to the at least two different regions, wherein at least a first portion of the input gas being delivered to the plasma processing chamber via the first outlet and a remaining portion of the input gas being delivered to the plasma processing chamber via the second outlet. Fujii et al. discloses an apparatus comprising a gas inlet receiving a single input gas which comprises a mixture of gases and delivering the single input gas to at least two different regions; wherein a first portion of the input gas can be delivered to the plasma processing chamber via a first outlet and the remaining portion of the input gas can be delivered to the plasma processing chamber via a second outlet (see, for example, figures 3 and 6, and their descriptions). Fujiyama et al. discloses an apparatus comprising a gas inlet receiving a single input gas which comprises a mixture of gases and delivering the single input gas to at least two different regions; wherein a first portion of the input gas can be delivered to the plasma processing chamber via a first outlet and the remaining

portion of the input gas can be delivered to the plasma processing chamber via a second outlet (see, for example, figs. 1 and 3, and their descriptions). Yamazaki et al. discloses an apparatus comprising a gas inlet receiving a single input gas which comprises a mixture of gases and delivering the single input gas to at least two different regions; wherein a first portion of the input gas can be delivered to the plasma processing chamber via a first outlet and the remaining portion of the input gas can be delivered to the plasma processing chamber via a second outlet (see, for example, figure 1 and its description). Therefore, in view of this disclosure, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Li et al. as to comprise the claimed gas inlet structure, because in such a way the same mixture of gases can be introduced to the chamber through the different regions. Furthermore, concerning the input gas being a mixture of gases or source gas suitable for use to etch said substrate in said plasma processing chamber, since an apparatus is being claimed as the instant invention, the method teachings are not considered to be the matter at hand, since a variety of methods can be done with the apparatus. Furthermore, the particular use for the source gas is viewed as an intended use that does not further limit, and therefore does not patentably distinguish the claimed invention. The apparatus of Li et al. modified by Fujii et al, Fujiyama et al. or Yamazaki et al. is capable of using a source gas that is suitable for etching the substrate in the plasma processing chamber.

Additionally, note that the flow system of the apparatus of Li et al. modified by Fujii et al, Fujiyama et al. or Yamazaki et al. can independently control the amount, volume or flow rate of the input gas into the at least two different regions of the plasma processing chamber. Furthermore, in the apparatus of Li et al., at least one of the outputs is configured to release the

gas into an inner region of the plasma process chamber, and at least a second output is configured to release the gas into an outer region of the process chamber. Additionally, the output gas of the apparatus of Li et al. modified by Fujii et al, Fujiyama et al. or Yamazaki et al., is mixed inside the gas flow controller. For example, in Fujii et al., gas line 20 is considered part of the gas flow controller; in Fujiyama et al. the gas line supplying the gases is also considered part of the gas flow controller; and in Yamazaki et al. note that there are three gas lines that are mixed inside the gas flow controller.

With respect to the gas flow system being configured to vary the amounts of first and remaining portions in order to control the distribution of neutral gas components inside the plasma processing chamber, note that the apparatus of Li et al. modified by Fujii et al. or Fujiyama et al. or Yamazaki et al. is capable of being configured in such a manner. Furthermore, concerning the substrate being a semiconductor substrate, note that this limitation is directed to a method limitation instead of an apparatus limitation and since an apparatus is being claimed as the instant invention, the method teachings are not considered to be the matter at hand, since a variety of methods can be done with the apparatus. The method limitations are viewed as intended uses that do not further limit, and therefore do not patentably distinguish the claimed invention. The apparatus of Li et al. modified by Fujii et al., Fujiyama et al., or Yamazaki et al. is capable of etching a semiconductor substrate.

Additionally, concerning claim 10, note that Li et al. discloses the use of gas rings in an upper peripheral region (gas ring 38).

Concerning claims 71 and 75, note that in the apparatus of Li et al. '830 modified by Fujii et al. or Yamazaki et al. or Fujiyama et al., inherently the input gas delivered to the upper region will spend more time inside the process chamber than the gas delivered to the lower region.

Claims 1-5, 7-10, 16-17, 50, 57, 59, 62, 67-68, 70-71, and 75 are rejected under 35 U.S.C. 103(a) as being unpatentable over Li et al., U.S. Patent 6,070,551 in view of Fujii et al., U.S. Patent 4,980,204, or Fujiyama et al., U.S. Patent 4,529,474, or Yamazaki et al., U.S. Patent 4,105,810.

Li et al. shows substantially the invention as claimed including a plasma processing system, said plasma processing system comprising: a substantially cylindrical plasma processing chamber 6 used to process a substrate 42, said substantially cylindrical plasma processing chamber including a top region 76 located on the top surface of said substantially cylindrical plasma processing chamber, an upper peripheral region (the region around gas nozzle 34a), and a lower peripheral region (the region around gas nozzle 34) located on a surface surrounding the periphery of said substantially cylindrical plasma processing chamber including at least an inner wall; a gas flow system operated by a processor (see col. 4-lines 59-65) and coupled to said plasma processing chamber, said gas flow system using controllers (37a,37,60) to control the flow of input gas into at least two different regions of said plasma processing chamber and comprising a gas inlet for receiving input gas to be delivered into the plasma processing chamber and at least first and second gas outlets; wherein said at least two different regions include a lower peripheral region and a top region of the chamber and the peripheral region is not part of the top region (see Fig. 3 and col. 4-line 33 to col. 5-line 63).

Li et al. does not expressly disclose the gas inlet receiving a single input gas comprising a mixture of etching gases and delivering the single input gas to the at least two different regions, wherein at least a first portion of the input gas being delivered to the plasma processing chamber via the first outlet and a remaining portion of the input gas being delivered to the plasma processing chamber via the second outlet. Fujii et al. discloses an apparatus comprising a gas inlet receiving a single input gas which comprises a mixture of gases and delivering the single input gas to at least two different regions; wherein a first portion of the input gas can be delivered to the plasma processing chamber via a first outlet and the remaining portion of the input gas can be delivered to the plasma processing chamber via a second outlet (see, for example, figures 3 and 6, and their descriptions). Fujiyama et al. discloses an apparatus comprising a gas inlet receiving a single input gas which comprises a mixture of gases and delivering the single input gas to at least two different regions; wherein a first portion of the input gas can be delivered to the plasma processing chamber via a first outlet and the remaining portion of the input gas can be delivered to the plasma processing chamber via a second outlet (see, for example, figs. 1 and 3, and their descriptions). Yamazaki et al. discloses an apparatus comprising a gas inlet receiving a single input gas which comprises a mixture of gases and delivering the single input gas to at least two different regions; wherein a first portion of the input gas can be delivered to the plasma processing chamber via a first outlet and the remaining portion of the input gas can be delivered to the plasma processing chamber via a second outlet (see, for example, figure 1 and its description). Therefore, in view of this disclosure, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Li et al. as to comprise the claimed gas inlet structure, because in such a

way the same gas (or mixture of gases) can be introduced to the chamber through the different regions. Furthermore, concerning the input gas being a mixture of gases or source gas suitable for use to etch said substrate in said plasma processing chamber, since an apparatus is being claimed as the instant invention, the method teachings are not considered to be the matter at hand, since a variety of methods can be done with the apparatus. Furthermore, the particular use for the source gas is viewed as an intended use that does not further limit, and therefore does not patentably distinguish the claimed invention. The apparatus of Li et al. modified by Fujii et al, Fujiyama et al. or Yamazaki et al. is capable of using a source gas that is suitable for etching the substrate in the plasma processing chamber.

With respect to the gas flow system being configured .to vary the amounts of first and remaining portions in order to control the distribution of neutral gas components inside the plasma processing chamber, note that the apparatus of Li et al. modified by Fujii et al. or Fujiyama et al. or Yamazaki et al. is capable of being configured in such a manner. Furthermore, concerning the first and second portions of said input gas having the same mixture of etchant source gases as said input gas and the substrate being a semiconductor substrate, note that this limitation is directed to a method limitation instead of an apparatus limitation and since an apparatus is being claimed as the instant invention, the method teachings are not considered to be the matter at hand, since a variety of methods can be done with the apparatus. The method limitations are viewed as intended uses that do not further limit, and therefore do not patentably distinguish the claimed invention. The apparatus of Li et al. modified by Fujii et al., Fujiyama et al., or Yamazaki et al. is capable of etching a semiconductor substrate and providing the gases as claimed.

Regarding claims 7-9, note that the flow system of the apparatus of Li et al. modified by Fujii et al, Fujiyama et al. or Yamazaki et al. can independently control the amount, volume or flow rate of the input gas into the at least two different regions of the plasma processing chamber.

With respect to claim 10, note that Li et al. suggests the replacement of the gas injectors of Fig. 1 with gas rings in an upper peripheral region as broadly interpreted (see col. 8-lines 7-22).

Concerning claim 50, note that in the apparatus of Li et al., one of the outputs is configured to release the gas into a top central region of the plasma process chamber (outlet 56), and a second output is configured to release the gas into an upper peripheral region of the process chamber (outlets 38). Furthermore, regarding the processing chamber being azimuthally symmetric, the configuration of the claimed chamber is a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed container was significant.

With respect to claim 57, note that the apparatus of Li et al. modified by Fujii et al. or Fujiyama et al. or Yamazaki et al. includes a gas channel housing and a gas delivery ring positioned around the periphery of the process chamber and cooperating to supply the first portion of the input gas into the upper peripheral region, the gas channel housing including a gas channel operatively coupled to the first gas outlet and extending around the periphery of the gas channel housing, the gas delivery ring including a series of holes providing openings between the gas channel and the upper internal areas of the process chamber, the first gas outlet supplying said first portion of said input gas to the gas channel, the gas channel equally distributing the first

portion of said input gas through each of the holes in the gas delivery ring, and the holes feeding the first portion of said input gas into the upper peripheral region of the process chamber.

Concerning the number of holes in the gas delivery ring, it would have been obvious to one of ordinary skill in the art at the time the invention was made to determine through routine experimentation the optimum number of holes in the gas delivery ring depending upon a variety of factors including the desired gas coverage area and such limitation would not lend patentability to the instant application absent a showing of unexpected results.

Regarding claims 67-68, note that the input gas in Li et al. is not mixed after leaving the flow controller and is delivered directly to the outlets.

Concerning claims 71 and 75, note that in the apparatus of Li et al. '551 modified by Fujii et al. or Yamazaki et al. or Fujiyama et al., inherently the input gas delivered to the upper region will spend more time inside the process chamber than the gas delivered to the lower region.

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Li et al., U.S. Patent 6,070,551 in view of Fujii et al., U.S. Patent 4,980,204, or Fujiyama et al., U.S. Patent 4,529,474, or Yamazaki et al., U.S. Patent 4,105,810, as applied to claims 1-5, 7-10, 16-17, 50, 57, 59, 62, 67-68, 70-71, and 75 above, and further in view of Wing et al., U.S. Patent 6,277,235.

Li et al., Fujii et al., Fujiyama et al. and Yamazaki et al. are applied as above but do not expressly disclose where the process gas that is flowed through the lower region of the chamber is flown through a chuck supporting a wafer. Wing et al. discloses flowing input gas through a chuck supporting a wafer (see fig. 1 and col. 3-line 19 to col. 4-line 22). In view of this

disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Li et al. modified by Fujii et al, Fujiyama et al. or Yamazaki et al. so as to flow input gas through the chuck as disclosed by Wing et al. because Wing et al. shows this as a suitable method to flow gas into a processing chamber.

Claims 58, 60-61, and 63-65 are rejected under 35 U.S.C. 103(a) as being unpatentable over Li et al., U.S. Patent 6,070,551 in view of Fujii et al., U.S. Patent 4,980,204, or Fujiyama et al., U.S. Patent 4,529,474, or Yamazaki et al., U.S. Patent 4,105,810 as applied to claims 1-5, 7-10, 16-17, 50, 57, 59, 62, 67-68, 70-71, and 75 above, and further in view of Li et al., U.S. Patent 6,009,830.

Li et al. '551, Fujii et al., Fujiyama et al., or Yamazaki et al. are applied as above but do not expressly disclose a gas distribution plate at the top central portion of the chamber. Li et al. '830 discloses a gas distribution plate 38 at the top central portion of the processing chamber for the distribution of gases (see fig. 2 and its description). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Li et al. '551 modified by Fujii et al. or Fujiyama et al. or Yamazaki et al. so as to have a gas distribution plate at the top central portion because in such a way the gas can be accurately directed to the surface of the wafer.

Regarding claims 60 and 63-64, note that the apparatus modified by Li et al. '551 modified by Fujii et al. or Fujiyama et al. or Yamazaki et al. and further modified by Li et al. produces the claimed invention.

Concerning claim 61, it would have been obvious to one of ordinary skill in the art at the time the invention was made to include a seal between the gas delivery ring and the vacuum plate and the walls and the delivery ring in order to provide for an adequate vacuum within the processing chamber.

Claims 1-5, 7-9, 16-17, 19, 23-25, 28-33, 35, 42-44, 48, 50, 54, 66-68, 70-73, and 75 are rejected under 35 U.S.C. 103(a) as being unpatentable over Collins et al., U.S. Patent 6,024,826 in view of Fujii et al., U.S. Patent 4,980,204, or Fujiyama et al., U.S. Patent 4,529,474, or Yamazaki et al., U.S. Patent 4,105,810.

Collins et al. shows the invention as claimed including a plasma processing system comprising: a substantially cylindrical plasma processing chamber within which a plasma is both ignited and sustained for processing a substrate 156, said plasma processing chamber having no separate plasma generation chamber, said plasma processing chamber having an upper end and a lower end and including a top region located on the top surface of the chamber, an upper peripheral region, and a lower peripheral region located on a surface surrounding the periphery of said processing chamber; and a gas flow system (164a-d, 300) coupled to said plasma processing chamber, said gas flow system controlling the flow of input gas into at least two different regions of said plasma processing chamber and comprising a gas inlet for receiving input gas to be delivered into the plasma processing chamber and at least first and second gas outlets; wherein said at least two different regions including at least one peripheral region located at a top side surface of said plasma processing chamber (gas lines 164d), at least one top region located at a center top surface of said plasma processing chamber (gas line 164 a), said

peripheral region being located closer to said upper end of said plasma processing chamber than said lower end of said plasma processing chamber; a lower peripheral region (gas line 164b), and a lower region near edges of the substrate (gas line 164c); and wherein the apparatus further comprises a coupling window disposed at an upper end of the plasma processing chamber, and an RF antenna arrangement disposed above a plane defined by the substrate when the substrate is disposed within the plasma processing chamber. For a complete description of the apparatus see, for example, figs. 8a-b, 9, and 13-21 and their descriptions.

Collins et al. further discloses that a process gas is furnished into the chamber through any one or all of the variety of gas lines (164a-d) but does not expressly disclose a gas inlet receiving a single input gas comprising a mixture of etching gases and delivering the single input gas to the at least two different regions, wherein at least a first portion of the input gas being delivered to the plasma processing chamber via the first outlet and a remaining portion of the input gas being delivered to the plasma processing chamber via the second outlet. Fujii et al. discloses an apparatus comprising a gas inlet receiving a single input gas which comprises a mixture of gases and delivering the single input gas to at least two different regions; wherein a first portion of the input gas can be delivered to the plasma processing chamber via a first outlet and the remaining portion of the input gas can be delivered to the plasma processing chamber via a second outlet (see, for example, figures 3 and 6, and their descriptions). Fujiyama et al. discloses an apparatus comprising a gas inlet receiving a single input gas which comprises a mixture of gases and delivering the single input gas to at least two different regions; wherein a first portion of the input gas can be delivered to the plasma processing chamber via a first outlet and the remaining portion of the input gas can be delivered to the plasma processing chamber via a second outlet

(see, for example, figs. 1 and 3, and their descriptions). Yamazaki et al. discloses an apparatus comprising a gas inlet receiving a single input gas which comprises a mixture of gases and delivering the single input gas to at least two different regions; wherein a first portion of the input gas can be delivered to the plasma processing chamber via a first outlet and the remaining portion of the input gas can be delivered to the plasma processing chamber via a second outlet (see, for example, figure 1 and its description). Therefore, in view of this disclosure, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Collins et al. as to comprise the claimed gas inlet structure, because in such a way the same mixture of gases can be introduced to the chamber through the different regions. Furthermore, concerning the input gas being a mixture of gases or source gas suitable for use to etch said substrate in said plasma processing chamber, since an apparatus is being claimed as the instant invention, the method teachings are not considered to be the matter at hand, since a variety of methods can be done with the apparatus. Furthermore, the particular use for the source gas is viewed as an intended use that does not further limit, and therefore does not patentably distinguish the claimed invention. The apparatus of Collins et al. modified by Fujii et al, Fujiyama et al. or Yamazaki et al. is capable of using a source gas that is suitable for etching the substrate in the plasma processing chamber.

With respect to the gas flow system being configured to vary the amounts of first and remaining portions in order to control the distribution of neutral gas components inside the plasma processing chamber, note that the apparatus of Collins et al. modified by Fujii et al. or Fujiyama et al. or Yamazaki et al. is capable of being configured in such a manner. Furthermore, concerning the first and second portions of said input gas having the same mixture of etchant

source gases as said input gas and the substrate being a semiconductor substrate, note that this limitation is directed to a method limitation instead of an apparatus limitation and since an apparatus is being claimed as the instant invention, the method teachings are not considered to be the matter at hand, since a variety of methods can be done with the apparatus. The method limitations are viewed as intended uses that do not further limit, and therefore do not patentably distinguish the claimed invention. The apparatus of Collins et al. modified by Fujii et al., Fujiyama et al., or Yamazaki et al. is capable of etching a semiconductor substrate and providing the gases as claimed.

Additionally, note that the flow system of the apparatus of Collins et al. modified by Fujii et al, Fujiyama et al. or Yamazaki et al. can independently control the amount, volume or flow rate of the input gas into the at least two different regions of the plasma processing chamber. Furthermore, in the apparatus of Collins et al., at least one of the outputs is configured to release the gas into an inner region of the plasma process chamber, and at least a second output is configured to release the gas into an outer region of the process chamber. Additionally, the output gas of the apparatus of Collins et al. modified by Fujii et al, Fujiyama et al. or Yamazaki et al., is mixed inside the gas flow controller. For example, in Fujii et al., gas line 20 is considered part of the gas flow controller; in Fujiyama et al. the gas line supplying the gases is also considered part of the gas flow controller; and in Yamazaki et al. note that there are three gas lines that are mixed inside the gas flow controller.

Regarding the shape of the processing chamber being azimuthally symmetric, the configuration of the claimed chamber is a matter of choice which a person of ordinary skill in the

art would have found obvious absent persuasive evidence that the particular configuration of the claimed container was significant.

Regarding claims 67-68, note that the input gas in Collins et al. is not mixed after leaving the flow controller and is delivered directly to the outlets.

Concerning claims 71 and 75, note that in the apparatus of Collins et al. modified by Fujii et al. or Yamazaki et al. or Fujiyama et al., inherently the input gas delivered to the upper region will spend more time inside the process chamber than the gas delivered to the lower region.

Claims 6 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Collins et al., U.S. Patent 6,024,826 in view of Fujii et al., U.S. Patent 4,980,204, or Fujiyama et al., U.S. Patent 4,529,474, or Yamazaki et al., U.S. Patent 4,105,810, as applied to claims 1-5, 7-9, 16-17, 19, 23-25, 28-33, 35, 42-44, 48, 50, 54, 66-68, 70-73, and 75 above, and further in view of Wing et al., U.S. Patent 6,277,235.

Collins et al., Fujii et al., Fujiyama et al. and Yamazaki et al. are applied as above but do not expressly disclose that the substrate holder comprises a chuck for supporting the wafer and wherein the process gas that is flowed through the lower region of the chamber is flown through the chuck. Wing et al. discloses the use of a chuck for supporting the wafer wherein an input gas is release through the chuck (see fig. 1 and col. 3-line 19 to col. 4-line 22). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Collins et al. modified by Fujii et al, Fujiyama et al. or Yamazaki et al. so as to further comprise a chuck for holding the wafer and to flow input gas

through the chuck as disclosed by Wing et al. because Wing et al. shows this as a suitable structure to hold the wafer and flowing gas into a processing chamber.

Claims 10 and 57-65 are rejected under 35 U.S.C. 103(a) as being unpatentable over Collins et al., U.S. Patent 6,024,826 in view of Fujii et al., U.S. Patent 4,980,204, or Fujiyama et al., U.S. Patent 4,529,474, or Yamazaki et al., U.S. Patent 4,105,810, as applied to claims 1-5, 7-9, 16-17, 19, 23-25, 28-33, 35, 42-44, 48, 50, 54, 66-68, 70-73, and 75 above, and further in view of Li et al., U.S. Patent 6,070,551.

Collins et al., Fujii et al., Fujiyama et al. and Yamazaki et al. are applied as above but do not expressly disclose the use of gas rings and a gas distribution plate at the top central portion of the chamber. Li et al. '830 discloses a gas distribution plate 38 at the top central portion of the processing chamber for the distribution of gases and that gas nozzles can be replaced by rings or ring-like structures since they are suitable gas introduction means (see fig. 2 and its description). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Li et al. '551 modified by Fujii et al. or Fujiyama et al. or Yamazaki et al. so as to have a gas distribution plate at the top central portion and gas rings because in such a way the gas can be accurately directed to the chamber and the surface of the wafer.

With respect to claim 57, note that the apparatus of Collins et al. et al. modified by Fujii et al. or Fujiyama et al. or Yamazaki et al. includes a gas channel housing and a gas delivery ring positioned around the periphery of the process chamber and cooperating to supply the first portion of the input gas into the upper peripheral region, the gas channel housing including a gas

channel operatively coupled to the first gas outlet and extending around the periphery of the gas channel housing, the gas delivery ring including a series of holes providing openings between the gas channel and the upper internal areas of the process chamber, the first gas outlet supplying said first portion of said input gas to the gas channel, the gas channel equally distributing the first portion of said input gas through each of the holes in the gas delivery ring, and the holes feeding the first portion of said input gas into the upper peripheral region of the process chamber.

Concerning the number of holes in the gas delivery ring, it would have been obvious to one of ordinary skill in the art at the time the invention was made to determine through routine experimentation the optimum number of holes in the gas delivery ring depending upon a variety of factors including the desired gas coverage area and such limitation would not lend patentability to the instant application absent a showing of unexpected results.

Regarding claims 60 and 63-64, note that the apparatus modified by Collins et al. modified by Fujii et al. or Fujiyama et al. or Yamazaki et al. and further modified by Li et al. produces the claimed invention.

Concerning claim 61, it would have been obvious to one of ordinary skill in the art at the time the invention was made to include a seal between the gas delivery ring and the vacuum plate and the walls and the delivery ring in order to provide for an adequate vacuum within the processing chamber.

Claims 45 and 74 are rejected under 35 U.S.C. 103(a) as being unpatentable over Collins et al., U.S. Patent 6,024,826 in view of Fujii et al., U.S. Patent 4,980,204, or Fujiyama et al., U.S. Patent 4,529,474, or Yamazaki et al., U.S. Patent 4,105,810, as applied to claims 1-5, 7-9, 16-17,

19, 23-25, 28-33, 35, 42-44, 48, 50, 54, 66-68, 70-73, and 75 above, and further in view of Ueda et al., U.S. Patent 5,810,932 and Kadomura, U.S. Patent 6,096,160.

Collins et al., Fujii et al., Fujiyama et al. and Yamazaki et al. are applied as above but fail to expressly disclose the electromagnet and dc supply arrangement as claimed. Ueda et al. discloses a chamber 15; a coupling window 11 disposed at an upper end of the chamber; an RF antenna 12 disposed above a plane defined by the substrate; and an electromagnet arrangement 14 proximate the antenna (see Figure 7 and its description). Additionally, Kadomura discloses a magnet arrangement 53 whereby a d.c. power supply 68 is coupled to the magnets and is varied in a controlled manner (see abstract) in order to better control the plasma. In view of these disclosures, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Collins et al. modified by Fujii et al., Fujiyama et al. or Yamazaki et al., so as to include the controller and electromagnet arrangement of Kadomura and Ueda et al. because such a control system allows for better controllability of the plasma system.

Claims 1-5, 7-10, 16-17, 19, 23-25, 28-33, 35, 42-44, 48, 54, 57, 59, 62, 66, 70-72, and 75 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murugesh et al., U.S. Patent 6,228,781 in view of Fujii et al., U.S. Patent 4,980,204, or Fujiyama et al., U.S. Patent 4,529,474, or Yamazaki et al., U.S. Patent 4,105,810.

Murugesh et al. shows the invention substantially as claimed including a plasma processing system 10 comprising: a plasma processing chamber within which a plasma is both ignited and sustained for processing a substrate 17, said plasma processing chamber having no

separate plasma generation chamber, and having an upper end and a lower end, the processing chamber including a top region 46 located on the top surface of said plasma processing chamber and an upper peripheral region (the region around gas nozzles 38,40) located on a surface surrounding the periphery of said plasma processing chamber; a gas flow system coupled to said plasma processing chamber (for example, 35A, 35A', 35B, 35B'), said gas flow system controlling flow of input gas into at least two different regions of said plasma processing chamber, wherein said at least two different regions include at least a top central region, an upper peripheral region, and a lower peripheral region of the chamber; wherein said upper peripheral region is closer to the upper end of the plasma processing chamber than the lower portion of the plasma processing chamber; a coupling window disposed at an upper end of the plasma processing chamber; and an RF antenna arrangement disposed within the plasma processing chamber, (see figs. 1A-1D and col. 4-line 43 to col. 8-line 10).

Murugesh et al. does not expressly disclose a cylindrical processing chamber.

However, regarding the shape of the chamber, such configuration is a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed coil is significant, see In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

Murugesh et al. does not expressly disclose a gas inlet receiving a single input gas comprising a mixture of etching gases and delivering the single input gas to the at least two different regions, wherein at least a first portion of the input gas being delivered to the plasma processing chamber via the first outlet and a remaining portion of the input gas being delivered to the plasma processing chamber via the second outlet. Fujii et al. discloses an apparatus

comprising a gas inlet receiving a single input gas which comprises a mixture of gases and delivering the single input gas to at least two different regions; wherein a first portion of the input gas can be delivered to the plasma processing chamber via a first outlet and the remaining portion of the input gas can be delivered to the plasma processing chamber via a second outlet (see, for example, figures 3 and 6, and their descriptions). Fujiyama et al. discloses an apparatus comprising a gas inlet receiving a single input gas which comprises a mixture of gases and delivering the single input gas to at least two different regions; wherein a first portion of the input gas can be delivered to the plasma processing chamber via a first outlet and the remaining portion of the input gas can be delivered to the plasma processing chamber via a second outlet (see, for example, figs. 1 and 3, and their descriptions). Yamazaki et al. discloses an apparatus comprising a gas inlet receiving a single input gas which comprises a mixture of gases and delivering the single input gas to at least two different regions; wherein a first portion of the input gas can be delivered to the plasma processing chamber via a first outlet and the remaining portion of the input gas can be delivered to the plasma processing chamber via a second outlet (see, for example, figure 1 and its description). Therefore, in view of this disclosure, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Murugesh et al. as to comprise the claimed gas inlet structure, because in such a way the same mixture of gases can be introduced to the chamber through the different regions. Furthermore, concerning the input gas being a mixture of gases or source gas suitable for use to etch said substrate in said plasma processing chamber, since an apparatus is being claimed as the instant invention, the method teachings are not considered to be the matter at hand, since a variety of methods can be done with the apparatus. Furthermore, the particular use

for the source gas is viewed as an intended use that does not further limit, and therefore does not patentably distinguish the claimed invention. The apparatus of Murugesh et al. modified by Fujii et al, Fujiyama et al. or Yamazaki et al. is capable of using a source gas that is suitable for etching the substrate in the plasma processing chamber.

With respect to the gas flow system being configured to vary the amounts of first and remaining portions in order to control the distribution of neutral gas components inside the plasma processing chamber, note that the apparatus of Murugesh et al. modified by Fujii et al. or Fujiyama et al. or Yamazaki et al. is capable of being configured in such a manner. Furthermore, concerning the first and second portions of said input gas having the same mixture of etchant source gases as said input gas and the substrate being a semiconductor substrate, note that this limitation is directed to a method limitation instead of an apparatus limitation and since an apparatus is being claimed as the instant invention, the method teachings are not considered to be the matter at hand, since a variety of methods can be done with the apparatus. The method limitations are viewed as intended uses that do not further limit, and therefore do not patentably distinguish the claimed invention. The apparatus of Murugesh et al. modified by Fujii et al., Fujiyama et al., or Yamazaki et al. is capable of etching a semiconductor substrate and providing the gases as claimed.

Additionally, note that the flow system of the apparatus of Murugesh et al. modified by Fujii et al, Fujiyama et al. or Yamazaki et al. can independently control the amount, volume or flow rate of the input gas into the at least two different regions of the plasma processing chamber. Furthermore, in the apparatus of Murugesh et al., at least one of the outputs is configured to release the gas into an inner region of the plasma process chamber, and at least a

second output is configured to release the gas into an outer region of the process chamber. Additionally, the output gas of the apparatus of Murugesh et al. modified by Fujii et al, Fujiyama et al. or Yamazaki et al., is mixed inside the gas flow controller. For example, in Fujii et al., gas line 20 is considered part of the gas flow controller; in Fujiyama et al. the gas line supplying the gases is also considered part of the gas flow controller; and in Yamazaki et al. note that there are three gas lines that are mixed inside the gas flow controller.

Regarding the shape of the processing chamber being azimuthally symmetric, the configuration of the claimed chamber is a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed container was significant.

Additionally, concerning claim 10, note that Murugesh et al. discloses the use of gas rings (gas ring 37).

With respect to claim 57, note that the apparatus of Murugesh et al. modified by Fujii et al. or Fujiyama et al. or Yamazaki et al. includes a gas channel housing and a gas delivery ring positioned around the periphery of the process chamber and cooperating to supply the first portion of the input gas into the upper peripheral region, the gas channel housing including a gas channel operatively coupled to the first gas outlet and extending around the periphery of the gas channel housing, the gas delivery ring including a series of holes providing openings between the gas channel and the upper internal areas of the process chamber, the first gas outlet supplying said first portion of said input gas to the gas channel, the gas channel equally distributing the first portion of said input gas through each of the holes in the gas delivery ring, and the holes feeding the first portion of said input gas into the upper peripheral region of the process chamber.

Concerning the number of holes in the gas delivery ring, it would have been obvious to one of ordinary skill in the art at the time the invention was made to determine through routine experimentation the optimum number of holes in the gas delivery ring depending upon a variety of factors including the desired gas coverage area and such limitation would not lend patentability to the instant application absent a showing of unexpected results.

Regarding claims 67-68, note that the input gas in Murugesh et al. is not mixed after leaving the flow controller and is delivered directly to the outlets.

Concerning claims 71 and 75, note that in the apparatus of Murugesh et al. modified by Fujii et al. or Yamazaki et al. or Fujiyama et al., inherently the input gas delivered to the upper region will spend more time inside the process chamber than the gas delivered to the lower region.

Claims 6 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murugesh et al., U.S. Patent 6,228,781, in view of Fujii et al., U.S. Patent 4,980,204, or Fujiyama et al., U.S. Patent 4,529,474, or Yamazaki et al., U.S. Patent 4,105,810, as applied to claims 1-5, 7-10, 16-17, 19, 23-25, 28-33, 35, 42-44, 48, 54, 57, 59, 62, 66, 70-72, and 75 above, and further in view of Wing et al., U.S. Patent 6,277,235.

Murugesh et al., Fujii et al., Fujiyama et al. and Yamazaki et al. are applied as above but do not expressly disclose where the process gas that is flowed through the lower region of the chamber is flown through a chuck supporting a wafer. Wing et al. discloses flowing input gas through a chuck supporting a wafer (see fig. 1 and col. 3-line- 19 to col. 4-line 22). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the

invention was made to modify the apparatus of Murugesh et al. modified by Fujii et al., Fujiyama et al. or Yamazaki et al., so as to flow input gas through the chuck as disclosed by Wing et al. because Wing et al. shows this as a suitable method to flow gas into a processing chamber.

Claims 45 and 74 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murugesh et al., U.S. Patent 6,228,781, in view of Fujii et al., U.S. Patent 4,980,204, or Fujiyama et al., U.S. Patent 4,529,474, or Yamazaki et al., U.S. Patent 4,105,810, as applied to claims 1-5, 7-10, 16-17, 19, 23-25, 28-33, 35, 42-44, 48, 54, 57, 59, 62, 66, 70-72, and 75 above, and further in view of Ueda et al., U.S. Patent 5,810,932 and Kadomura, U.S. Patent 6,096,160.

Murugesh et al., Fujii et al., Fujiyama et al., or Yamazaki et al. are applied as above but fails to expressly disclose the electromagnet and dc supply arrangement as claimed. Ueda et al. discloses a chamber 15; a coupling window 11 disposed at an upper end of the chamber; an RF antenna 12 disposed above a plane defined by the substrate; and an electromagnet arrangement 14 proximate the antenna (see Figure 7 and its description). Additionally, Kadomura discloses a magnet arrangement 53 whereby a d.c. power supply 68 is coupled to the magnets and is varied in a controlled manner (see abstract) in order to better control the plasma. In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Murugesh et al. modified by Fujii et al., Fujiyama et al. or Yamazaki et al., so as to include the controller and electromagnet arrangement of Kadomura and Ueda et al. because such a control system allows for better controllability of the plasma system.

Claims 58 and 60-61 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murugesh et al., U.S. Patent 6,228,781 in view of Fujii et al., U.S. Patent 4,980,204, or Fujiyama et al., U.S. Patent 4,529,474, or Yamazaki et al., U.S. Patent 4,105,810 as applied to claims 1-5, 7-10, 16-17, 19, 23-25, 28-33, 35, 42-44, 48, 54, 57, 59, 62, 66, 70-72, and 75 above, and further in view of Li et al., U.S. Patent 6,009,830.

Murugesh et al. '781, Fujii et al., Fujiyama et al., or Yamazaki et al. are applied as above but do not expressly disclose a gas distribution plate at the top central portion of the chamber. Li et al. '830 discloses a gas distribution plate 38 at the top central portion of the processing chamber for the distribution of gases (see fig. 2 and its description). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Li et al.'551 modified by Fujii et al. or Fujiyama et al. or Yamazaki et al. so as to have a gas distribution plate at the top central portion because in such a way the gas can be accurately directed to the surface of the wafer.

Regarding claim 60, note that the apparatus modified by Murugesh et al. '781 modified by Fujii et al. or Fujiyama et al. or Yamazaki et al. and further modified by Li et al. produces the claimed invention.

Concerning claim 61, it would have been obvious to one of ordinary skill in the art at the time the invention was made to include a seal between the gas delivery ring and the vacuum plate and the walls and the delivery ring in order to provide for an adequate vacuum within the processing chamber.

(10) Response to Argument

A. Applicant has argued that there is support in the specification indicating the gases in claims 63 and 69 are identical or exact.

Concerning applicant's statements regarding the gases being identical or exact, as stated in the above rejection under 35 USC 112, first paragraph, this is not supported by the specification because the composition of the gas can be effected, for example, by impurities contained in the piping and therefore without support in the specification the fact that gases coming from different regions are exact or identical cannot be assumed.

B. Applicant has argued that the prior art (Li (551), Murugesh, Fujii, Yamazaki, Fujiyama) teach deposition chambers and fail to teach a plasma etcher.

Concerning the fact that some of the references show deposition processes while many of the claims require etching, note that this limitation is directed to a method limitation instead of an apparatus limitation and since an apparatus is being claimed as the instant invention, the method teachings are not considered to be the matter at hand, since a variety of methods can be done with the apparatus. The method limitations are viewed as intended uses that do not further limit, and therefore do not patentably distinguish the claimed invention. The apparatuses described in the above rejections are capable of etching a semiconductor substrate and providing the gases as claimed. Furthermore, an apparatus claims cover what a device is, not what a device does." Hewlett-Packard Co. v. Bausch & Lomb Inc., 909 F.2d 1464, 1469, 15 USPQ2d 1525, 1528 (Fed. Cir. 1990) (emphasis in original)

C. Applicant has argued that the design of a deposition chambers are different than etch chambers and there is no motivation to combine the two different chambers.

However, a claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. Ex parte Masham, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987). In the instant case, the prior art teaches the structural limitations of the claim and the process of etching or depositing is considered intended use and thus of no significance in determining patentability. The only difference between an etching apparatus and a depositing apparatus is the type of gas used in the apparatus. The prior art apparatuses are capable of supplying etching gases. Furthermore, expressions relating the apparatus to contents thereof during an intended operation are of no significance in determining patentability of the apparatus claim." Ex parte Thibault, 164 USPQ 666, 667 (Bd. App. 1969). Moreover, etching and depositing apparatus are analogous art since they are both plasma-assisted processes and they both are concerned with the same problems in the area of semiconductor manufacturing. Thus, since the structure for both etching and depositing apparatus are the same, the motivation to combine is to provide a source gas that is suitable for etching a substrate in a plasma processing chamber.

D. Applicant has argued that Li'551 feeds multiple gases individually and is all about being able to deliver different mixtures; however, the present invention feeds a single mixture thereby always ensuring the same mixture is fed to the different regions. It should be noted that one cannot show nonobviousness by attacking references individually where the rejections are based

on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). In the instant case, Li'551 was applied to disclose the claimed structure specifically having a substantially cylindrical plasma processing chamber, a gas flow system controlling the input gas to different regions, a gas inlet and at least two gas outlets, and wherein the different regions include a peripheral region and a top region in the chamber. Fujii et al., Fujiyama et al., or Yamazaki et al. was applied to teach a single input gas which comprises a mixture of gases and delivering the single input gas to at least two different regions. Thus, the combination of Li'551 in view of Fujii et al., Fujiyama et al., or Yamazaki et al. satisfy the claimed requirements.

E. Murugesh (6228781) is all about delivering different gases, purging, managing cleaning, etc. They have many flow controllers 35A-A', 35B-B', etc. that go to multiple areas thereby making it very difficult to perform key element of the present invention, i.e., adjusting the gas ratio with a sure identical single mixture. It should be noted that one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). In the instant case, Murugesh was applied to disclose the claimed structure specifically having a substantially cylindrical plasma processing chamber, a gas flow system controlling the input gas to different regions, a gas inlet and at least two gas outlets, and wherein the different regions include a peripheral region and a top region in the chamber. Fujii et al., Fujiyama et al., or Yamazaki et al. was applied to teach a single input gas which comprises a mixture of gases and delivering the single

input gas to at least two different regions. Thus, the combination of Murugesh in view of Fujii et al., Fujiyama et al., or Yamazaki et al. satisfy the claimed requirements.

F. Applicant has argued that Collins (6024826) teaches seven independent gas supplies, which is very complex and difficult to control. In contrast, the present invention feeds a single mixture thereby always ensuring the same mixture is fed to the different regions. In addition, Collins does not teach rationing to different regions. It should be noted that one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). In the instant case, Collins et al. was applied to disclose the claimed structure specifically having a substantially cylindrical plasma processing chamber, a gas flow system controlling the input gas to different regions, a gas inlet and at least two gas outlets, and wherein the different regions include a peripheral region and a top region in the chamber. Fujii et al., Fujiyama et al., or Yamazaki et al. was applied to teach a single input gas which comprises a mixture of gases and delivering the single input gas to at least two different regions. Thus, the combination of Collins et al. in view of Fujii et al., Fujiyama et al., or Yamazaki et al. satisfy the claimed requirements.

G. Applicant has argued that Li (6009830) mixes gas inside delivery lines and needs to set individual flows into the delivery lines to set ratio. In contrast, the present invention makes it easy to use a standard gas box with a bunch of MFCs to set a single gas mixture with a single sum total flow (sccm) that is then split by setting a single ratio to two different portions of the

chamber. It should be noted that one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). In the instant case, Li'830 was applied to disclose the claimed structure specifically having a substantially cylindrical plasma processing chamber, a gas flow system controlling the input gas to different regions, a gas inlet and at least two gas outlets, and wherein the different regions include a peripheral region and a top region in the chamber. Fujii et al., Fujiyama et al., or Yamazaki et al. was applied to teach a single input gas which comprises a mixture of gases and delivering the single input gas to at least two different regions. Thus, the combination of Li'830 in view of Fujii et al., Fujiyama et al., or Yamazaki et al. satisfy the claimed requirements.

H. Applicant has argued that Fujii does not deliver the same gas to two different regions; however, it should be noted that one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). In the instant case, Fujii et al. was applied to teach a single input gas which comprises a mixture of gases and delivering the single input gas to at least two different regions. The at least two different regions 111, 112, 113, 114 are located in the top of the chamber. Li'551, Murugesh, Collins et al., or Li'830 teach that the at least two different regions include a peripheral region and a top region. As stated above, the combination of Li'551, Murugesh, Collins et al., or Li'830 in view of Fujii et al. satisfy the claimed requirement.

I. Applicant has argued that Fujiyama discloses gas emitting tube 4 and gas emitting ring 9 that emit different gases at different times and thus the flow of a single gas is not controlled or rationized to two different regions; however, it should be noted that one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). In the instant case, Fujiyama et al. was applied to teach a single input gas which comprises a mixture of gases and delivering the single input gas to at least two different regions. The at least two different regions 4 are located along the periphery and the top periphery of the chamber. Li'551, Murugesh, Collins et al., or Li'830 teach controlling the input gas into at least two different regions including a peripheral region and a top region. As stated above, the combination of Li'551, Murugesh, Collins et al., or Li'830 in view of Fujiyama satisfy the claimed requirement.

J. Applicant has argued that Yamazaki does not deliver gas to two different regions, and further does not control or rationize the exiting gases; however, it should be noted that one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). In the instant case, Yamazaki was applied to teach a single input gas which comprises a mixture of gases and delivering the single input gas to at least two different regions. The at least two different regions are located in the top of the chamber. Li'551, Murugesh, Collins et al., or Li'830 teach controlling the input gas into at least two different regions including a peripheral region and a top region. As stated

above, the combination of Li'551, Murugesh, Collins et al., or Li'830 in view of Yamazaki satisfy the claimed requirement.

K. With respect to arguments against claim 1, applicant has argued that Fujii does not deliver the same gas to two different regions; however, as stated above (section H), it should be noted that one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). In the instant case, Fujii et al. was applied to teach a single input gas which comprises a mixture of gases and delivering the single input gas to at least two different regions. The at least two different regions 111, 112, 113, 114 are located in the top (four locations including top center and top side) of the chamber. Li'551, Murugesh, Collins et al., or Li'830 teach that the at least two different regions include a peripheral region and a top region. As stated above, the combination of Li'551, Murugesh, Collins et al., or Li'830 in view of Fujii et al. satisfy the claimed requirement.

L. With respect to arguments against claim 1, applicant has argued that Fujiyama discloses gas emitting tube 4 and gas emitting ring 9 that emit different gases at different times and thus the flow of a single gas is not controlled to two different regions; however, it should be noted that one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). In the instant case,

Fujiyama et al. was applied to teach a single input gas which comprises a mixture of gases and delivering the single input gas to at least two different regions. The at least two different regions 4, 9 are located along the periphery and top periphery of the chamber. Li'551, Murugesh, Collins et al., or Li'830 teach controlling the input gas into at least two different regions including a peripheral region and a top region. As stated above, the combination of Li'551, Murugesh, Collins et al., or Li'830 in view of Fujiyama satisfy the claimed requirement.

M. With respect to arguments against claim 1, applicant has argued that Yamazaki simply teaches the gases are only introduced at a top region as shown by Fig. 1 and thus gases are not delivered to two different regions; however, it should be noted that one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). In the instant case, Yamazaki was applied to teach a single input gas which comprises a mixture of gases and delivering the single input gas to at least two different regions. The at least two different regions are located in the top (3 locations including top center and top side) of the chamber. Li'551, Murugesh, Collins et al., or Li'830 teach that the at least two different regions include a peripheral region and a top region. As stated above, the combination of Li'551, Murugesh, Collins et al., or Li'830 in view of Yamazaki satisfy the claimed requirement.

N. Applicant has argued, with respect to claim 19, that the combination of Collins or Murugesh in view of Fujii, Fujiyama or Yamazaki fails to teach the claimed requirement. As

stated above, it should be noted that one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). In the instant case, Collins et al. or Murugesh was applied to disclose the claimed structure specifically having a substantially cylindrical plasma processing chamber, a gas flow system controlling the input gas to different regions, a gas inlet and at least two gas outlets, and wherein the different regions include a upper peripheral region and a top central region in the chamber. Fujii et al., Fujiyama et al., or Yamazaki et al. was applied to teach a single input gas which comprises a mixture of gases and delivering the single input gas to at least two different regions. Thus, the combination of Collins et al. in view of Fujii et al., Fujiyama et al., or Yamazaki et al. satisfy the claimed requirements.

O. Applicant has argued, with respect to claim 50, that in the primary references Li (551), Collins, and Murugesh, different gases (NOT the same gas as required by the claim) are fed individually into different portions of the chamber. As stated above, it should be noted that one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). See arguments applied in letters D-F.

P. Applicant has argued, with respect to claim 50, that Collins does not teach adjusting the

amount of the input gas that is delivered to each of said first and second outputs; however, in column 19, line 64-column 20, line 2 and column 22, lines 33-35, Collins teaches a controller 300 that controls the input gas that is delivered to each of the first and second outputs 164a-d (Fig. 8a). Thus, Collins satisfies the claimed requirements.

Q. Furthermore, concerning applicant's contention that many of the dependent claims are not properly rejected in the above rejections, the examiner respectfully submits that the rejections as stated above properly reject the claims as stated in the headings of the respective rejections.

In summary, each of the rejected claims is obvious for the reasons argued at length above. It is respectfully stressed that the apparatus of Li'551, Li'830, Collins, or Murugesh in view of Fujii et al., Fujiyama et al., or Yamazaki et al. disclose a plasma processing chamber used to process a substrate and a gas flow system coupled to the plasma processing chamber. The gas flow system controls flow of a single input gas into at least two different regions of the plasma processing chamber. As examples, at least two different regions can be selected from a top region and a peripheral region.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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